

**Rejections Under 35 U.S.C § 103(a)**

The following rejections under 35 U.S.C. § 103(a) are presented by the Examiner.

Claims 1, 2, and 4-5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Urairi *et al.*, JP 2003-236929 (hereinafter “Urairi”) in view of Zhao *et al.*, Censors and Actuators, Vol. 65, pp. 209-217 (1998) (hereinafter “Zhao”) and Venkatakrishnan *et al.*, “Laser Writing Techniques for Photomask Fabrication Using a Femtosecond Laser,” Applied Physics A, Vol. 74, pp. 493-496 (2002) (hereinafter “Venkatakrishnan”).

Claim 6 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Urairi, in view of Zhao, and Venkatakrishnan and further view of Misawa *et al.*, Laser Applications and Microelectronic and Optoelectronic Manufacturing V, Vol. 3933, pp. 246-260 (2000) (hereinafter “Misawa”).

Applicants respectfully traverse the above rejections.

The Examiner asserts that the present application is obvious in light of the cited references, as indicated on pages 2-6 of the outstanding Office Action.

Based on the following, Applicants contend that the Examiner’s position is not supportable, thereby making the presently claimed invention unobvious over the cited references.

Applicants request that the Examiner reconsider the response dated March 12, 2010 in view of the following comments.

As indicated in MPEP § 2143, the Examiner must resolve the factors described in *Graham v. John Deere*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), which provides the controlling framework for an obviousness analysis, before utilizing the rationales that were established in *KSR Int’l Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

Applicants provide the following information regarding the *Graham* factor of ascertaining the differences between the prior art and the claims that are at issue.

Applicants herein incorporate by reference the discussion concerning the Urairi and Zhao references from the March 12, 2010 response.

Additionally, for the Examiner's consideration, Applicants enclose as an exhibit, a 37 C.F.R. § 1.132 Declaration from Dr. Hiroaki MISAWA, one of the inventors of the present application.

The presently claimed invention is a micro-fabrication method which comprises applying a femtosecond pulse laser beam to a plastic material that is to be processed, which exhibits a glass phase transition by heating and having heat-shrinkage that forms laser-processed patterns on the surface of or in the plastic material. The formed laser-processed pattern is only scaled down by heat treatment without its shape being changed. The plastic material to be processed is heat-treated at a temperature not lower than a glass transition temperature ( $T_g$ ) in order to scale down the formed patterns by heat-shrinkage.

With the above in mind, Applicants submit that for the presently claimed invention, it is important that the plastic material to be processed is applied with a femtosecond pulse laser beam so as to be formed into a laser-processed pattern and that the plastic material in which the laser-processed pattern is formed is heat-treated at a temperature that is not lower than the glass transition temperature ( $T_g$ ) thereof.

As a result of applying the femtosecond pulse laser beam, due to the temperature elevation caused by the application of the femtosecond pulse laser beam, only the local site that has been processed by applying the femtosecond pulse laser beam shrinks.

Subsequently, the plastic material in which the laser-processed pattern is formed is heat-treated at a temperature that is not lower than the glass transition temperature ( $T_g$ ) thereof.

Accordingly, the formed laser-processed pattern is scaled down through shrinkage, which results from the temperature elevation caused by the heat-treatment.

In other words, the application of the femtosecond pulse laser beam induces shrinkage of only the local site processed by applying the femtosecond pulse laser beam. The formed laser-processed pattern is reduced in size by the subsequent heat treatment at a temperature that is not lower than the glass transition temperature ( $T_g$ ) and is thus it is scaled down. In the heat treatment, since the part to be processed has been already reduced in size, due to the previous application of the femtosecond pulse laser beam, the formed laser-processed pattern is merely scaled down by the heat treatment. However, Applicants note that the shape of the formed laser-processed pattern does not change.

Applicants submit that based on the following, these results would not have been predictable by one of ordinary skill in the art.

It has been said that processing of a transparent material by the use of a laser, which has a long pulse width as a light source, is thermal processing. However, Applicants contend that the microprocessing of a transparent material by the use of a femtosecond laser is a non-thermal processing. In other words, in a case where a transparent material is processed by the use of a femtosecond laser, no thermal damage (effect) occurs. In fact, Applicants note as a reference, U.S. Patent No. 5,656,186, which has been granted for use of non-thermal microprocessing of a transparent material with a femtosecond laser.

As indicated in the supplied Declaration, Dr. MISAWA has reported many research papers, utilizing non-thermal microprocessing of a transparent material with a femtosecond laser. A list of publications from DR. MISAWA concerning femtosecond laser processing is also provided with the enclosed Declaration.

In contrast to the above, the presently claimed invention has first clarified that with regard to microprocessing of a transparent material by the use of a femtosecond laser, only the site processed by applying the femtosecond pulse laser beam shrinks. Applicants submit that this is due to the temperature elevation caused by the application of the femtosecond pulse laser beam. In other words, the microprocessing of a transparent material by the use of a femtosecond laser is not a non-thermal treatment.

Dr. MISAWA, who is an expert that has conducted studies of femtosecond laser processing, indicates that the above is a surprising result, which could not have been predicted by one of ordinary skill in the art. Dr. MISAWA has reported these findings in the research paper no. 30, (from the attached list of publications), which has been provided with the enclosed Declaration.

From the above, Applicants submit that the microprocessing of a transparent material by the use of a femtosecond laser, which is not a non-thermal treatment, is not predictable to one of ordinary skill in the art.

Additionally, the fact that the formed laser-processed pattern is only scaled down by heat treatment at a temperature not lower than the glass transition temperature ( $T_g$ ) without its shape being changed could not have been predicted by one of ordinary skill in the art.

*Obviousness has not been Established*

Applicants submit that based on the above, the Examiner has not resolved the *Graham* factor of ascertaining the differences between the prior art and the claims that are at issue, and therefore the rationales the Examiner provides for the rejections are improper.

Applicants note that although the above comments discuss the references individually, this was only for discussing these references in terms of the *Graham* factor analysis. Applicants submit that taking the above *Graham* analysis in mind, and that the microprocessing of a

transparent material by the use of a femtosecond laser, which is not a non-thermal treatment, is not predictable to one of ordinary skill in the art (as well as the fact that the formed laser-processed pattern is only scaled down by heat treatment at a temperature not lower than the glass transition temperature ( $T_g$ ) without its shape being changed is unpredictable), the references do not lead to the presently claimed invention.

In light of the above remarks and Declaration, Applicants submit that the assertions made by the Examiner regarding the above cited references are incorrect, thus failing to support the Examiner's position. Accordingly, based on the differences between the presently claimed invention and the above references, the cited references do not teach or suggest the presently claimed invention.

Since claim 1 is not obvious to one of ordinary skill in the art, claims 2, 4 and 5, which depend from claim 1, are unobvious over the cited references for the same reasoning discussed above.

With regard to the rejection to claim 6, since it ultimately depends from claim 1, it is also unobvious over the cited references for the same reasons discussed above.

Applicants respectfully request reconsideration and withdrawal of the rejection.

### **Conclusion**

Applicants respectfully submit that all of the rejections raised by the Examiner have been overcome, and that the present application now stands in condition for allowance.

Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact Paul D. Pyla at the telephone number below, in an effort to expedite prosecution in connection with the present application.

Respectfully submitted,

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